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# Chemical and Spectrophotometric Evolutionary Models for Emission Line Star-forming Galaxies

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**Abstract.**
We present a self-consistent model under a star-bursting scenario for HII galaxies, combining different codes of chemical evolution, evolutionary population synthesis and photoionization. The results obtained reproduce simultaneoulsy the observed abundances, diagnostic diagrams and equivalent width-colour relations for local HII galaxies.

## 1. Introduction

The current burst of star formation (SF) dominates the spectral energy distribution (SED) in HII galaxies even if previous stellar populations are present, making difficult to know the star formation history (SFH) of the galaxy. In order to understand how the SF takes place we study the viability of a model (Martín-Manjón et al. 2008) using simultaneously the whole available information for the galaxy sample: the ionized gas, which defines the present time state of the galaxy, and spectrophotometric parameters, related to the galaxy SFH.

We assume 11 successive attenuated star-bursts along 13.2 Ga in a region with a total gas mass of $10^8 M_\odot$. In each burst a certain amount of gas is consumed to form stars with a given initial efficiency. The SFH and the age-metallicity relation are given by the chemical evolution code (based on Ferrini et al. 1994). The SED of the ionizing population is computed using the single stellar populations (SSP's) from Mollá & García-Vargas (2000). Finally, the emission lines are calculated by the photoionization code CLOUDY (Ferland et al. 1998).

## 2. Main Model Results

The evolution of the oxygen abundance is shown in Fig. 1a. Models with initial efficiencies $\epsilon \sim 10\%$ to $33\%$ reproduce the data range of HII galaxies,(Hoyos & Díaz 2006, dashed lines). Once the SED of the ionizing continuum is computed, we obtain the emission lines, giving information about the current burst of SF. Fig. 1b shows an excitation diagram for the ionized nebula. The model reproduces the observational data for HII galaxies. The effect of an underlying population should be more easily seen in the observed colours of these galaxies, since any star-burst previous to the currently observed one will contribute

substantially to the total continuum luminosity at the different wavebands. The broad band colours with and without the contribution by the stronger emission lines are shown in Fig. 1c (dashed and solid lines respectively).

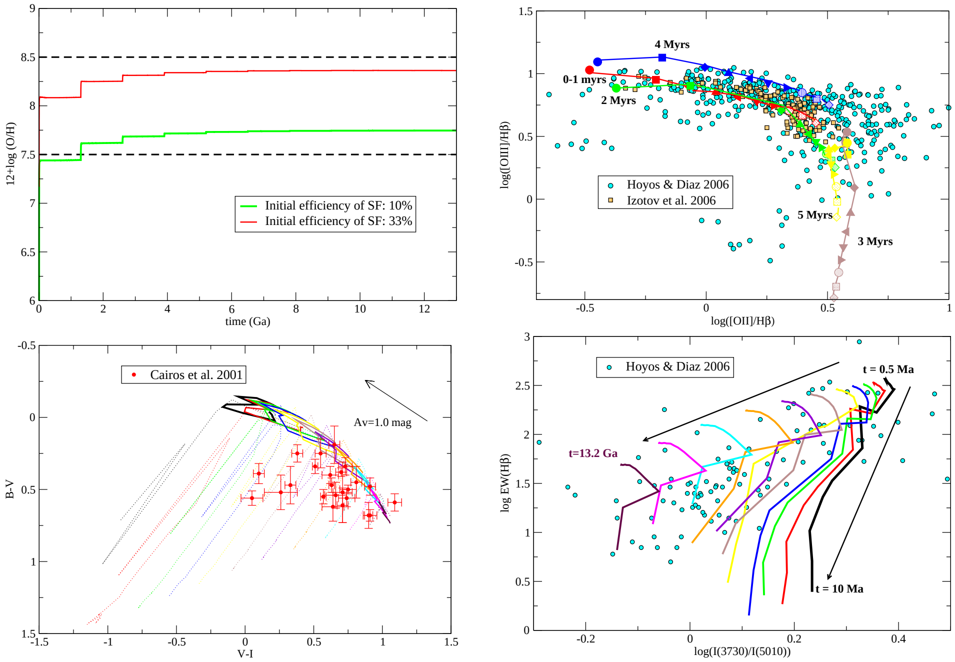


Figure 1. a)Oxygen abundance with efficiencies $\epsilon = 0.3$ and 0.1. b)Diagnostic diagram, c)Broad-band colors,d)Relation EW(H$\beta$) *vs* I(3729)/I(5010) ($\epsilon = 0.3$ model).

Most of observed EW(H$\beta$) values for HII galaxies are lower than 150Å which implies the existence of an old non ionizing population. We plot the evolution of EW(H$\beta$) *vs* the pseudo-color I(3729)/I(5010) for the successive bursts of our model with $\epsilon = 0.3$ in Fig 1d. The data trend is reproduced by our model, not by any SSP. A metal-poor SSP (black solid line) show bluer colours than observed. In order to decrease EW(H$\beta$) and obtain redder colours, a more metal-rich ($Z \sim Z_\odot$) SSP might be selected, but such high abundance is not observed. According to our model, a stellar population of at least 1.3Ga must contribute to the continuum, making it redder and, simultaneously, decreasing EW($\beta$). In summary, our model reproduces abundances, colours, and emission lines of HII galaxies.

## References

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